

# A COMMON LAND ATTACK WARFARE SYSTEM (CLAWS) FOR AEGIS COMBATANTS

Mr. Laurence C. Weeks and Mr. James E. Ball

*With the breakup of the Soviet Union, the Navy's once primary mission of defending the open oceans from the Soviet threat has been refocused on the ability to project power ashore from the sea—anytime and anywhere. In 2001 the Navy plans to introduce the first in a series of precision-guided land attack weapons on board Aegis ships. This article summarizes a vision of a fully integrated Common Land Attack Warfare System (CLAWS) for Aegis combatants.<sup>1</sup> CLAWS will enable a single set of operators to perform all land attack functions across both gun and missile systems. In conjunction with the combat system and weapon control systems, these new weapons will enable Aegis combatants to provide responsive, sustainable, coordinated and synchronized fires across multiple platforms as a key part of the joint land battle. Full CLAWS functionality is being planned for integration into a future Aegis baseline upgrade, with the goal of backfitting this capability on designated DDG 51 and CG 47 class ships.*

## INTRODUCTION

The 2001 planned introduction of the first in a series of enhanced land attack weapon systems on Aegis ships will complement the existing strategic Tomahawk cruise missile capability. The first enhancement is the introduction of an upgraded gun weapon system with a 63-nautical mile (NM) range. This capability will be followed in 2003 with: (1) a tactical version of the Tomahawk missile with a range of 600 NM, and (2) a supersonic land attack missile with a 150 NM range. These new land attack gun and missile weapons will utilize the Global Positioning System to provide all-weather, highly accurate, and lethal fires.

To fully realize these new land attack capabilities, corresponding advances are required in theater and platform command, control, communications, computers, intelligence, surveillance, reconnaissance, and targeting (C4ISRT) systems across numerous program offices. The goal is to create a land attack warfare mission area equivalent to that of air defense or maritime dominance.

## COMMON LAND ATTACK WARFARE SYSTEM (CLAWS)

CLAWS will consolidate top-level requirements from weapon system and weapon control system-specific operational requirement documents, along with numerous requirement

papers and publications that cover various portions of the surface combatant land attack warfare problem, into a unified system. By leveraging the functionality of the Aegis combat system, the naval fires control system, and the Tactical Tomahawk weapon control system, CLAWS will provide an integrated command and control, information management, tactical picture management, planning, targeting, and execution system for engaging land targets. Reference 2 provides the draft CLAWS functional requirements. The driving force behind CLAWS is to meet the joint force commander's firepower and responsiveness requirements while maintaining and, preferably, reducing the manpower required to safely perform the land attack functions on board ship.

CLAWS will encompass the missions of naval surface fire support (NSFS) including counterfire, suppression of enemy air defenses, interdiction, strategic attack and defensive counterbattery. All land attack weapons (gun, land attack missile, and Tomahawk), as well as future nonlethal assets, will be available to support strategic, operational, or tactical land attack warfare. To support these missions and levels of warfare, CLAWS must be capable of receiving and utilizing all applicable joint force, Navy, and combat system information for situational awareness, coordination, synchronization, and deconfliction. Although full digital connectivity among all land attack assets is the goal, voice communications will be retained as a backup capability.

To meet the vision stated in this article, CLAWS must be fully integrated with the Aegis combat system. Surface combatant operational requirements have consistently stressed responsiveness, lethality, sustainability, and affordability across all warfare mission areas. These requirements—along with increased emphasis on reduced manning, faster land attack mission response times, and coordination and synchronization with other joint fires—mandate a highly automated and integrated CLAWS solution. CLAWS will provide the commanding officer (CO) and combat information center (CIC) personnel a flexible and responsive warfighting capability fully interoperable with the ship's other warfare areas, as well as both Navy and joint mission areas.

Because Aegis Baseline 6 will continue the migration to commercially developed displays, processors and peripherals in an open-system distributed architecture (to be completed in Baseline 7), CLAWS will notionally be a software integration of the currently separate land attack subsystems. An advantage of the distributed architecture is that these various subsystems can be physically located anywhere on the network.

CLAWS will be Defense Information Infrastructure (DII) Common Operating Environment (COE) compliant. As such, CLAWS will notionally consist of ship-independent functional segments integrated by an overarching ship-dependent segment that communicates with the Aegis combat system over a defined interface. This implementation strategy will allow all of the ship-independent modules to be reused on non-Aegis platforms. This concept will also enable the rapid insertion of technology, packaged in DII COE segments, as it becomes available.

## **SURFACE COMBATANT ROLES**

For each level of warfare (strategic, operational, or tactical), CLAWS must be capable of supporting the combatant in a dependent, independent, or coordinating operational role.

### **Dependent Unit**

In the dependent role, the ship is subordinate to a joint fires coordination center that provides planning, coordination, deconfliction, and fire missions. Battlespace deconfliction is performed off board, and the ship is responsible only for local area deconfliction.

### **Independent Unit**

For the independent role the ship is either the "first to arrive on scene" or "last to leave the scene"; thus, no higher level on-scene commander or joint fires coordination center is available. The ship conducts fire missions from received calls-for-fire, or will

originate missions acquired by organic and offboard targeting sensors in accordance with the joint force commander's guidance. The ship performs all coordination and local/battlespace deconfliction.

### **Coordinating Unit**

When assigned, the ship acts as the coordinating unit for several fire support units in accordance with the joint force commander's instructions. The ship assigns missions to assets under its control, and performs both local and airspace deconfliction.

### **TARGETING INFORMATION**

The combatant will provide fires to meet both the joint force commander's strategic and operational level objectives and the ground component commander's tactical fires support objectives. For tactical and operational fires, joint fires coordination centers will designate target objectives to the ship for destruction or neutralization.

If required, the ship will utilize organic sensors and communicate directly with nonorganic sensors to develop targeting quality information to execute missions against target lists received from the coordination centers. Organic sensors include the AN/SPY-1 radar (for counterfire), electro-optic sights, and the future tactical unmanned aerial vehicle (UAV). Nonorganic sources will include tactical and theater UAVs, the Joint Surveillance and Target Attack Radar System (JSTARS), various reconnaissance aircraft, and space-based sensor systems. In areas where joint fires coordination has not been established, the ship may be required to perform target selection and acquisition in accordance with the joint force commander's guidance.

To support the coordination and synchronization of joint fires, future communication systems must leverage evolving technologies, programs, and joint service initiatives. Land attack communication systems must provide reliable, high-bandwidth, over-the-horizon, sensor-to-shooter, and command and control connectivity.

### **LAND ATTACK WEAPONS**

Aegis land attack weapon systems will include the Tomahawk cruise missiles (Blocks II, III, and Tactical), a supersonic land attack missile, and the upgraded 5-inch/62-caliber gun using both conventional munitions and the Extended Range Guided Munition (ERGM). Although both ERGM and the land attack missile are "fire and forget" weapons, the Tactical Tomahawk cruise missiles will be monitored and controlled by a two-way satellite communications link. Tactical Tomahawks will have the capability to "loiter" in an area and be retargeted in flight to engage emerging and time-critical targets. In addition, Tactical Tomahawks can also transmit battle damage assessment imagery from previous strikes back to the ship.

Current weapon control systems include:

- ◆ The naval fires control system that will provide planning and coordination for NSFS missions
- ◆ The Mk 34 Gun Weapon System
- ◆ The land attack missile weapon control system
- ◆ The Tactical Tomahawk weapon control system

### **COMMON LAND ATTACK TACTICAL PICTURE**

The CO/tactical action officer (TAO) and all CIC watchstanders must share a common land attack tactical picture across naval units as well as joint force units ashore and in the air. In the past, multiple command and control systems have been developed to provide separate air, surface, and subsurface tactical pictures. Divergence of these systems has led to a disjointed tactical picture across joint units. Therefore, one system aboard the combatant must be responsible for developing and maintaining the land attack tactical picture that will be common across the combat system at the command, coordinator, and supervisor/operator levels. The platform level tactical picture will leverage the common operational/tactical pictures available through the Global Command and Control System—Maritime's DII COE architecture.

## **COMBAT INFORMATION CENTER (CIC) ORGANIZATION**

The existing CIC organization will evolve to accommodate the additional operator functionality imposed by the introduction of new land attack warfare capabilities. Currently the land attack mission areas of conventional NSFS and Tomahawk strategic attack are supported within CIC. However, these missions are manpower intensive and are conducted by different groups of operators and support personnel (phone talkers, status board keepers, etc.). The addition of significant new land attack operator functionality (e.g., information management, tactical picture management, UAV control, target acquisition, mission planning, and coordination of other land attack units) highlights the need to develop a unified land attack CIC organization. This organization will be capable of simultaneously planning, targeting, and executing multiple fire missions using all available weapons and resources, with no increase in manpower requirements.

### **Multiwarfare Operations**

The CIC organization is designed to function effectively across several warfare areas at the same time. However, this requirement will be severely stressed when the ship operates close to shore where significant air, surface, subsurface and land-based threats exist; and when combined with reduced warning times, land masking effects, and clutter typical of littoral operational areas. The ship may be tasked to operate in this near-shore environment to extend the inland reach of weapons, to reduce weapon time of flight, or to use the SPY radar for counterfire missions.

### **Flexible Manning Structure**

During low-intensity operations, when there is no requirement for conducting land attack planning or fire missions, a full land attack team will generally not be on watch. In order to respond to increasing operational activities, the concept of flexible

manning will be used. In flexible or “flex manning,” the ship’s standard condition-based readiness organization is replaced with a more streamlined organization that starts with a “core watch” for routine operations and then draws from a support matrix to provide or “flex” additional watchstanders in narrower, mission-specific areas determined by operational requirements. All flex watchstanders will require certification across several mission areas and weapon systems. These additional watchstander responsibilities will be eased by the automation of functions and the use of standardized displays and procedures.

For land attack, the core watch would require a watchstander to maintain the tactical picture and provide an initial capability to conduct limited fire missions. Additional manning would be flexed from a support matrix as the complexity and task loading of the operational situation increases. Once the joint fires missions are completed, the added watchstanders would be flexed out of the matrix for resuming sustained combat operations. As a goal, during low-intensity peacetime steaming, one supervisor will oversee all land attack operations.

This dynamic restructuring of operators is supported by general-purpose consoles. Any console can be used by any CIC watchstander, regardless of the warfare area assignment, to best address the immediate tactical needs. To maintain this flexibility while minimizing the number of consoles required, “land attack” consoles must be functionally interchangeable with other consoles as required to fulfill mission needs.

### **Land Attack Team**

The land attack team will mirror the basic command, coordinator, and operator structural organization followed by the other warfare areas in CIC today. Furthermore, all watchstanders will have immediate access to any appropriate tactical data and tasking activities, and watchstanders will have all appropriate controls to accomplish this access implemented at their consoles. A notional battle organization is shown in Figure 1.

The command-level watchstanders are the CO and the TAO who exercise command level responsibility over all CIC operations. A land attack warfare coordinator (LAWC) will have responsibility for the land attack warfare mission area and will report to the CO/TAO. The LAWC will be responsible for maintaining a near real-time land attack capability as required when the ship is conducting other warfare missions. The LAWC, essentially the “land attack liaison officer,” will assume the responsibilities of the former gun liaison officer.

For high-intensity land attack operations, the LAWC will supervise several “flexed” operator level watchstanders who will execute the following four notional operating level functions shown in Figure 1:

- ◆ Information Management—Manage, receive, and process organic and nonorganic land attack information
- ◆ Tactical Picture Management—Maintain the land attack tactical picture and provide appropriate assessments
- ◆ Mission Planning and Targeting—Create and/or maintain fire mission plans and coordinate with organic and nonorganic assets. Develop precision targeting data as required
- ◆ Mission Execution—Conduct fire missions

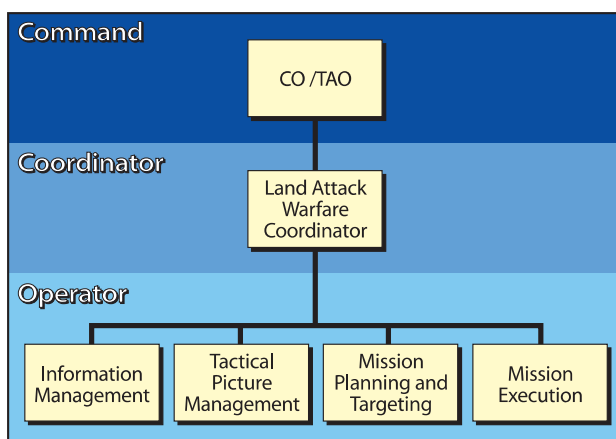


Figure 1—Notional CIC Land Attack Functional Organization

## IMPLEMENTATION

CLAWS was originally scheduled for full integration with the Aegis combat system for the Aegis Baseline 7 Phase 1 follow-on in 2005. However, with the cancellation of this Baseline, it is now unknown when this integration will actually occur. The CLAWS-Aegis integration remains a candidate for a future baseline upgrade and/or a backfit capability on designated DDG 51 and CG 47 class ships.

Regardless of the CLAWS-Aegis integration schedule, the creation of CLAWS from the various gun and missile control systems will continue. The following shows the tentative CLAWS implementation schedule by year:

- ◆ Today: Tomahawk Block II and III, Advanced Tomahawk Weapon Control System
- ◆ 2001: ERGM, naval fires control system
- ◆ 2003: Tactical Tomahawk, Tactical Tomahawk weapon control system
- ◆ 2003: Land attack missile, land attack missile weapon control system
- ◆ 2004: Integration of the naval fires control system with the Tactical Tomahawk weapon control system
- ◆ 2005: Integration of the land attack missile weapon control system with the Tactical Tomahawk weapon control system

## REFERENCES

1. Weeks, L., *Surface Combatant Land Attack Guidance Document*, 28 June 99 Draft.
2. Weeks, L., *Common Land Attack Warfare System (CLAWS) System Requirements Document*, 25 January 99 Draft.

## THE AUTHORS

MR. LAURENCE C. WEEKS

---



Mr. Laurence C. Weeks has been the Aegis Land Attack Systems Engineer supporting PMS400B3L for the Aegis Combat System Engineering Branch since 1997. He has led a multiorganizational team to define the land attack problem for Aegis combatants and to develop the follow-on Land Attack System Requirements Document. He is currently involved with developing a Collaborative Land Attack System Engineering Environment with B, G, K, N, and T Departments. After participating in the Cooperative Work Program at the Goddard Space Flight Center, Mr. Weeks graduated from Purdue University in 1973 with a B.S. degree in aeronautical engineering and in 1974 with an M.S. degree in fluid dynamics. Mr. Weeks was employed at the Naval Surface Warfare Center, Dahlgren Division (NSWCDD)-White Oak in 1975, working in the areas of hypervelocity research and underwater acoustics/signal processing. From 1991-1997 Mr. Weeks headed the Surface Ship Undersea Warfare Self Defense Section; and from 1992-1997 he served as the principal investigator for the 6.2 Undersea Warfare Combat Control Technology Project—Tactical Engagement: Assessment, Planning, and Control Task. This Task developed a prototype, knowledge-based reasoning system for an integrated surface ship torpedo defense capability that was demonstrated as part of the Defense Advanced Research Projects Agency's Ship Systems Automation Program. While at White Oak, Mr. Weeks served a 14-month rotational assignment with the PEO-USW-Advanced Systems and Technology Office; and from 1993-1996 he served as the NSWCDD representative on the international Technical Cooperation Program's Undersea Warfare Data Integration panel. Mr. Weeks transferred to NSWCDD-Dahlgren in 1995.

MR. JAMES E. BALL

---



Mr. James E. Ball has been the lead PCI Senior Systems Engineer supporting the Aegis Combat System Engineering Branch for the past 18 months. During this period, he has been responsible for preparing the land attack guidance and system requirements documents for Aegis combatants in the 21st Century. Mr. Ball graduated from West Virginia University Institute of Technology with a B.S. degree in mathematics in 1962. He completed graduate work in probability theory and statistics through American University and the University of California at Los Angeles. Mr. Ball retired from the Navy Civil Service after 33 years spent at both NSWCDD and the Naval Warfare Center (NWC) at China Lake, California. From 1962-1965 he was the lead reliability engineer for the Marine Corps MK 4 Chemical Field Filling Unit at NSWCDD. From 1966-1970 he was the Navy's lead systems analyst for modeling and forecasting the effectiveness of chemical and biological weapon systems at NWC, China Lake. From 1970-1974, he was the Navy's lead systems analyst for modeling and forecasting the vulnerability of Navy ships to chemical and biological attack. From 1975 to 1991 he was head of the Weapons Effectiveness Branch at NSWCDD, responsible for modeling and forecasting the end-game effectiveness of Navy gun and missile systems. From 1992-1995 he was the head of the Weapon Systems Branch, responsible for modeling and forecasting the performance of self-defense combat weapon systems in maintaining ship survivability from attack by antiship cruise missiles. In 1995 he received the Navy Meritorious Civilian Service Award for leading a multilaboratory team to define signature requirements for the next-generation surface combatant.